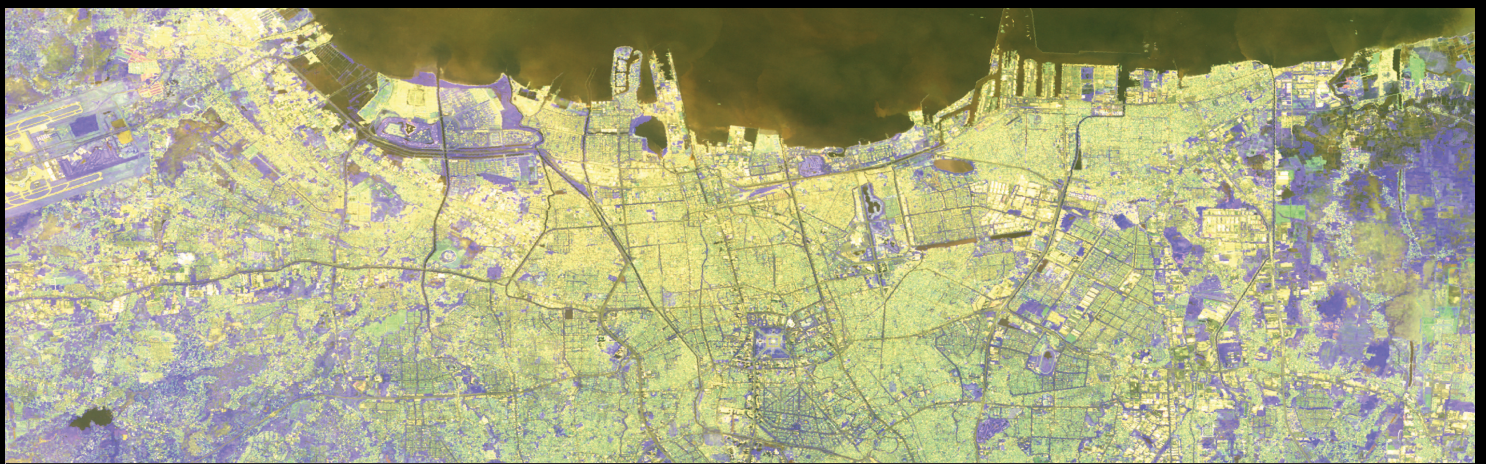


Malaria Modeling and Surveillance:

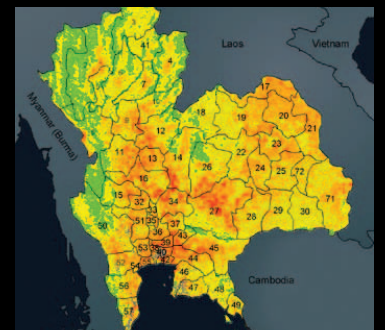
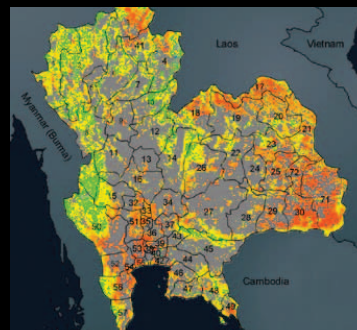
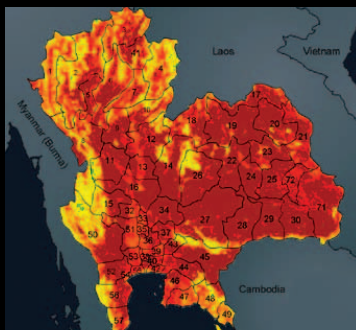
Using NASA Data to Combat the Threat of Disease



An ASTER image of flooding in Indonesia

Not only had the floods directly damaged infrastructure, but diseases such as cholera, malaria, diarrhea, and measles spread as a result of unsanitary conditions and contaminated drinking water.

Malaria is spread by Anoph-
eles mosquitoes.



Surface temperature (MODIS images above), vegetation index, and rainfall are some of the parameters used to model malaria incidences in Thailand.

Goals:

Detection of potential larval habitats of malaria vectors

Assessment of malaria endemicity and prediction of malaria risks

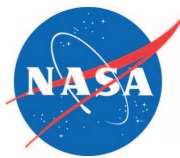
Modeling spatiotemporal transmission patterns among humans and households

Outcomes:

Application of larvicide or elimination of potential larval habitats as preventive measures

Early warning for public health organizations to implement countermeasures for pending outbreaks or elevated prevalence

Identification of cost-effective measures to curtail transmission and reduce endemicity



Malaria Modeling and Surveillance

Using NASA Data to Combat the Threat of Malaria

Summary

The goal of the Malaria Modeling and Surveillance project is to enhance the decision support capabilities of the Air Force Special Operation Command to combat the threat of malaria. Remotely sensed observations, including temperature, precipitation, vegetation density, and humidity, are essential components to this project, as well as Earth science models for climate prediction. The entomological data for this project are provided by the Armed Forces Research Institute and the Naval Medical Research Unit No. 2. The Ministries of Health in Afghanistan, Indonesia, and Thailand, as well as the World Health Organization Southeast Asian Regional Office provide the epidemiology data. This project encompasses malaria surveillance in several countries including Thailand, Indonesia, and Afghanistan.

Social Benefits

The risk detection result from the mosquito larval habitat identification will permit the application of larval control as a preventive measure for malaria outbreaks. The risk prediction outcome from the assessment of current and future malaria endemicity will strengthen and mobilize the public health support to combat malaria. Finally, the risk reduction from the malaria transmission model will allow authorities to curtail malaria transmission in a cost effective manner. These measures will reduce morbidity and mortality for US personnel in the affected areas, improve public health for local populations, reduce damage to the environment, and reduce malaria incidence. This will in turn lead to a decrease in insecticide use and the potential emergence of insecticide-resistant mosquitoes.

Project Details

The transmission of malaria is influenced by environmental and climatic factors; data from remote sensing instruments

are key components to malaria monitoring and control models. In current models, data come from a variety of remote sensing instruments as well as epidemiology statistics. Precipitation data are obtained from the Tropical Rainfall Measuring Mission (TRMM), and the Seasonal to Interannual Earth Science Information Partner (SIESIP) temperature and rainfall data set compiled by the Center for Climate Research of the University of Delaware. The Land Surface Temperature (LST) and Normalized Difference Vegetation Index (NDVI) produced by the Moderate Resolution Imaging Spectroradiometer (MODIS), onboard the Terra and Aqua satellites, are also key factors in determining where malaria outbreaks may occur. Data obtained from other sources, like the Global Precipitation Climatology Center (GPCC), and ground stations data provided by NOAA/NCDC, the Global Historical Climatology Network (GHCN), and the Climate Research Unit (CRU) are also helpful in improving model accuracy. Modeled climate prediction data derived from the NASA Seasonal to Interannual Prediction Project (NSIPP) are used to depict needed environmental parameters.

High-resolution remote sensing observations, including images acquired by the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) aboard the Terra spacecraft, are frequently used to identify potential larval habitats.

The above remote sensing products, Earth science models, and epidemiology data are all assimilated into the malaria monitoring and control models. For malaria prediction and forecasting, models generated with several statistical methods are used. A discrete event simulation is used for the malaria transmission model to assess malaria prevalence and to evaluate the predominant factors in malaria outbreaks and control.

For more information about this project

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NASA APPLIED SCIENCES PROGRAM & PUBLIC HEALTH

This application area focuses on the use of NASA assets to support planning and decision making for the public health, medical, and environmental health sectors. The application includes epidemiologic surveillance of infectious disease, environmental health, and emergency response and preparedness. Public Health also explores issues of toxic and pathogenic exposure, natural and man-made hazards for risk characterization and mitigation, and improvements to health and safety.

Key Web sites

Applied Sciences Public Health:
<http://appliedsciences.nasa.gov/public-health>